Project Introduction

The proposed novel program will use measurements of high-energy photon output from celestial gamma-ray sources to design a new, unique navigation system for a deep space CubeSat demonstration. An integrated CubeSat design will be developed to demonstrate the performance and feasibility of the Gamma-ray source Localization-Induced Navigation and Timing, or "GLINT", technology and software developed under a previous NASA Phase I SBIR. In this past research, our team established the feasibility of using photons from gamma-ray bursts (GRBs) to provide deep-space vehicles the capability for self-navigation, showing that with key improvements to detector and timing instrumentation, the technique could achieve three-dimensional position accuracies of less than one kilometer. In this proposed research, recent developments in these hardware components will facilitate the design of a high resolution GRB monitor and precise timing circuit board, which, due to their size, weight, and power requirements, are prime candidates for integration into a 6U or smaller CubeSat. The mission proposed will fly two 3U-sized CubeSats equipped with this system, which will use time differenced of arrival measurements from the same observed GRB to determine a relative position solution. The GLINTSAT demonstration mission will measure the performance capabilities of this system. The team will design the mission architecture, including system requirements and components. An advanced photon timing instrument board will be designed, along with an accompanying high-resolution gamma-ray detector. Integration into the 3U CubeSat design will be detailed. Navigation performance will be evaluated using the designs and a prototype laboratory relative timing experiment. An integrated system error budget will be produced and the mission performance will be assessed to establish the feasibility and detail the path to environmental testing and full CubeSat system development for a 2017-timeframe launch.

Deep Space CubeSat Gamma-ray Navigation Technology Demonstration, Phase I
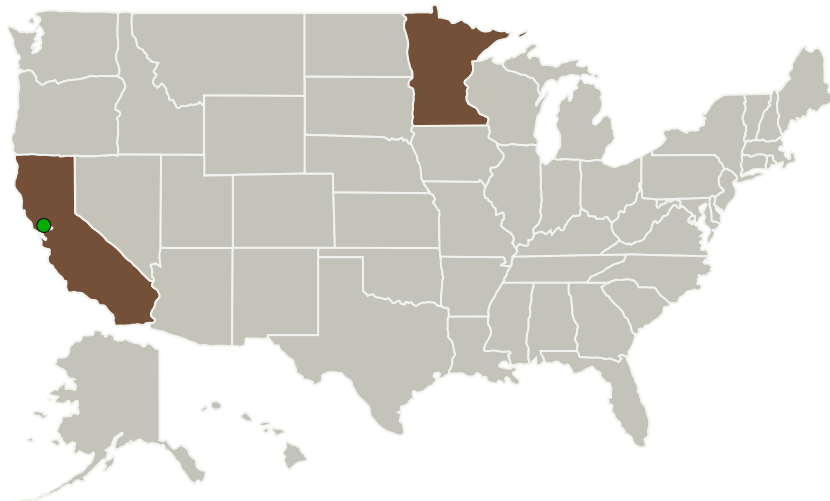
Table of Contents

Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
ASTER Labs, Inc.	Lead Organization	Industry Small Disadvantaged Business (SDB)	Shoreview, Minnesota
● Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations	
California	Minnesota

Project Transitions

▶ **June 2014:** Project Start

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

ASTER Labs, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

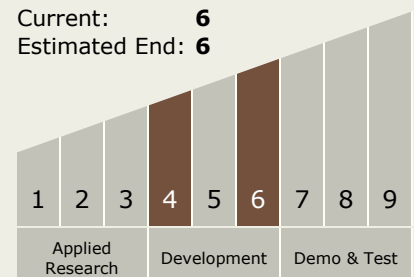**Program Director:**

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Suneel I Sheikh

Technology Maturity (TRL)

Start: **4**
Current: **6**
Estimated End: **6**

1	2	3	4	5	6	7	8	9
Applied Research			Development			Demo & Test		

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For more information and an accessible alternative, please visit:
https://techport.nasa.gov/view/17771

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✓ **December 2014:** Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/137445)*

Images
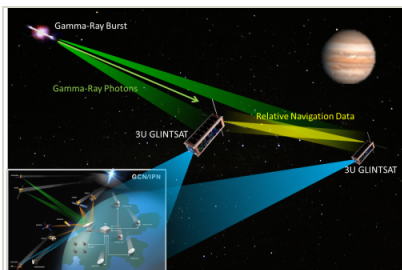
Briefing Chart
Deep Space CubeSat Gamma-ray
Navigation Technology
Demonstration, Phase I
*(https://techport.nasa.gov/imag
e/131501)*

Technology Areas

Primary:

- TX05 Communications,
  Navigation, and Orbital
  Debris Tracking and
  Characterization Systems
  └ TX05.4 Network Provided
    Position, Navigation, and
    Timing
    └ TX05.4.1 Timekeeping
      and Time Distribution

Target Destinations

The Sun, Earth, The Moon,
Mars, Others Inside the Solar
System, Outside the Solar
System